ATSDR Agency for Toxic Substances & Disease Registry

Public Health Statement for Trichloroethylene

(*Tricloroetileno*)

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This Public Health Statement is the summary chapter from the Toxicological Profile for trichloroethylene. It is one in a series of Public Health Statements about hazardous substances and their health effects. A shorter version, the ToxFAQs™, is also available. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present. For more information, call the ATSDR Information Center at 1-888-422-8737.

This public health statement tells you about trichloroethylene and the effects of exposure.

The Environmental Protection Agency (EPA) has identified 1,428 hazardous waste sites as the most serious in the nation. These sites make up the National Priorities List (NPL) and are targeted for long-term federal clean-up. Trichloroethylene has been found in at least 861 NPL sites. However, it's unknown how many NPL sites have been evaluated for this substance. As EPA looks at more sites, the sites with trichloroethylene may increase. This is important because exposure to this substance may harm you and because these sites may be sources of exposure.

When a substance is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. This release does not always lead to exposure. You are exposed to a substance only when you come in contact with it by breathing, eating, touching, or drinking.

If you are exposed to trichloroethylene, many factors will determine whether you'll be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. You must also consider the other chemicals you're exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

1.1 What is trichloroethylene?

Trichloroethylene is also known as Triclene and Vitran and by other trade names in industry. It is a nonflammable, colorless liquid at room temperature with a somewhat sweet odor and a sweet, burning taste. Trichloroethylene is now mainly used as a solvent to remove grease from metal parts. It is also used as a solvent in other ways and is used to make other chemicals. Trichloroethylene can also be found in some household products, including typewriter correction fluid, paint removers, adhesives, and spot removers. Most people can begin to smell

trichloroethylene in air when there are around 100 parts of trichloroethylene per million parts of air (ppm).

1.2 What happens to trichloroethylene when it enters the environment?

By far, the biggest source of trichloroethylene in the environment is evaporation from factories that use it to remove grease from metals. It can also enter the air and water when it is disposed of at chemical waste sites. It evaporates easily but can stay in the soil and in groundwater. Once it is in the air, about half will be broken down within a week. When trichloroethylene is broken down in the air, phosgene, a lung irritant, can be formed.

Trichloroethylene can break down under high heat and alkaline conditions to form dichloroacetylene and phosgene. In the body, trichloroethylene may break down into dichloroacetic acid (DCA), trichloroacetic acid (TCA), chloral hydrate, and 2-chloroacetaldehyde. These products have been shown to be toxic to animals and are probably toxic to humans. Once trichloroethylene is in water, much will evaporate into the air; again, about half will break down within a week. It will take days to weeks to break down in surface water. In groundwater the breakdown is much slower because of the much slower evaporation rate. Very little trichloroethylene breaks down in the soil, and it can pass through the soil into underground water. It is found in some foods. The trichloroethylene found in foods is believed to come from contamination of the water used in food processing, or from food processing equipment cleaned with trichloroethylene. It does not build up in fish, but low levels have been found in them.

1.3 How might I be exposed to trichloroethylene?

Trichloroethylene is found in the outdoor air at levels far less than 1 ppm. When measured several years ago, some of the water supplies in the United States were found to have trichloroethylene. The most recent monitoring study found average levels in surface water ranging from 0.0001 to 0.001 ppm of water and an average level of 0.007 ppm in groundwater. About 400,000 workers are routinely exposed to trichloroethylene in the United States. The chemical can also get into the air or water in many ways, for example, at waste treatment facilities; by evaporation from paints, glues, and other products; or by release from factories where it is made. Another way you may be exposed is by breathing the air around factories that use the chemical. People living near hazardous waste sites may be exposed to it in the air or in their drinking water, or in the water used for bathing or cooking. Products that may contain trichloroethylene are some types of typewriter correction fluids, paints and paint removers, glues, spot removers, rug cleaning fluids, and metal cleaners.

1.4 How can trichloroethylene enter and leave my body?

Trichloroethylene enters your body when you breathe air or drink water containing it. It can also enter your body if you get it on your skin. You could be exposed to contaminated water or air if you live near or work in a factory that uses trichloroethylene or if you live near a waste disposal site that contains trichloroethylene. If you breathe the chemical, about half the

amount you breathe in will get into your bloodstream and organs. You will exhale the rest. If you drink trichloroethylene, most of it will be absorbed into your blood. If trichloroethylene comes in contact with your skin, some of it can enter your body, although not as easily as when you breathe or swallow it.

Once in your blood, your liver changes much of the trichloroethylene into other chemicals. The majority of these breakdown products leave your body in the urine within a day. You will also quickly breathe out much of the trichloroethylene that is in your bloodstream. Some of the trichloroethylene or its breakdown products can be stored in body fat for a brief period, and thus may build up in your body if exposure continues.

1.5 How can trichloroethylene affect my health?

To protect the public from the harmful effects of toxic chemicals and to find ways to treat people who have been harmed, scientists use many tests.

One way to see if a chemical will hurt people is to learn how the chemical is absorbed, used, and released by the body; for some chemicals, animal testing may be necessary. Animal testing may also be used to identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method to get information needed to make wise decisions to protect public health. Scientists have the responsibility to treat research animals with care and compassion. Laws today protect the welfare of research animals, and scientists must comply with strict animal care guidelines.

Trichloroethylene was once used as an anesthetic for surgery. People who are exposed to large amounts of trichloroethylene can become dizzy or sleepy and may become unconscious at very high levels. Death may occur from inhalation of large amounts. Many people have jobs where they work with trichloroethylene and can breathe it or get it on their skin. Some people who get concentrated solutions of trichloroethylene on their skin develop rashes. People who breathe moderate levels of trichloroethylene may have headaches or dizziness. It is possible that some people who breathe high levels of trichloroethylene may develop damage to some of the nerves in the face. People have reported health effects when exposed to the level of trichloroethylene at which its odor is noticeable. Effects have also occurred at much higher levels.

The effects reported at high levels include liver and kidney damage and changes in heart beat. The levels at which these effects occur in humans are not well characterized. Animals that were exposed to moderate levels of trichloroethylene had enlarged livers, and high-level exposure caused liver and kidney damage.

It is uncertain whether people who breathe air or drink water containing trichloroethylene are at higher risk of cancer, or of having reproductive effects. More and more studies suggest that more birth defects may occur when mothers drink water containing trichloroethylene. People who used water for several years from two wells that had high levels of trichloroethylene may have had a higher incidence of childhood leukemia than other people, but these findings are not conclusive. In another study of trichloroethylene exposure from well water, increased numbers of children were reported to be born with heart defects, which is supported by data from some animal studies showing developmental effects of trichloroethylene on the heart. However, other chemicals were also in the water from this well and may have contributed to these effects.One study reported a higher number of children with a rare defect in the respiratory system and eye defects. Another study reported that the risk for neural tube defects

and oral cleft palates were higher among mothers with trichloroethylene in their water during pregnancy. Children listed in the National Exposure Subregistry of persons exposed to trichloroethylene were reported to have higher rates of hearing and speech impairment. There are many questions regarding these reports. There were small numbers of children with defects and trichloroethylene levels at which the effects occurred were not defined well. Thus, it is not possible to make firm conclusions about the exact effects of trichloroethylene from these studies, and more studies need to be done.

We do not have any clear evidence that trichloroethylene alone in drinking water can cause leukemia or any other type of cancer in humans. As part of the National Exposure Subregistry, the Agency for Toxic Substances and Disease Registry (ATSDR) compiled data on 4,280 residents of three states (Michigan, Illinois, and Indiana) who had environmental exposure to trichloroethylene. It found no definitive evidence for an excess of cancers from trichloroethylene exposure. An increase of respiratory cancer was noted in older men, but this effect was thought to result from smoking rather than trichloroethylene exposure. A study in New Jersey found an association between leukemia in women and exposure to trichloroethylene in the drinking water. A study in Massachusetts found that exposure was associated with leukemia in children.In studies with people, there are many factors that are not fully understood. More studies need to be done to establish the relationship between exposure to trichloroethylene and cancer.

In studies using high doses of trichloroethylene in rats and mice, tumors in the lungs, liver, and testes were found, providing some evidence that high doses of trichloroethylene can cause cancer in experimental animals. Based on the limited data in humans regarding trichloroethylene exposure and cancer, and evidence that high doses of trichloroethylene can cause cancer in animals, the International Agency for Research on Cancer (IARC) has determined that trichloroethylene is probably carcinogenic to humans. Trichloroethylene has been nominated for listing in the National Toxicology Program (NTP) 9th Report on Carcinogens. Evaluation of this substance by the NTP review committee is ongoing.

1.6 Is there a medical test to determine whether I have been exposed to trichloroethylene?

There are some tests that can show if you have been recently exposed to trichloroethylene since this chemical can be measured in your breath. Also, a doctor can have trichloroethylene or a number of breakdown products of trichloroethylene measured in your urine or blood. None of these tests, however, is routinely available at your doctor's office. If the measurements are done soon after the exposure, the breath levels can indicate whether you have been exposed to a large amount of trichloroethylene or only a small amount. Urine and blood tests can also show if you have been exposed to large amounts of this chemical. Because one of the breakdown products leaves your body very slowly, it can be measured in the urine for up to about 1 week after trichloroethylene exposure. However, exposure to other similar chemicals can produce the same breakdown products in your urine and blood. Therefore, these methods cannot determine for sure whether you have been exposed to trichloroethylene.

1.7 What recommendations has the federal government made to protect human health?

The federal government develops regulations and recommendations to protect public health. Regulations can be enforced by law. Federal agencies that develop regulations for toxic substances include the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA). Recommendations provide valuable guidelines to protect public health but cannot be enforced by law. Federal organizations that develop recommendations for toxic substances include the Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH).

Regulations and recommendations can be expressed in not-to-exceed levels in air, water, soil, or food that are usually based on levels that affect animals, then they are adjusted to help protect people. Sometimes these not-to-exceed levels differ among federal organizations because of different exposure times (an 8-hour workday or a 24-hour day), the use of different animal studies, or other factors.

Recommendations and regulations are also periodically updated as more information becomes available. For the most current information, check with the federal agency or organization that provides it. Some regulations and recommendations for trichloroethylene include the following.

EPA has set a drinking water standard of 5 parts of trichloroethylene per one billion parts of water (ppb). One ppb is 1,000 times less than 1 ppm. This standard became effective on January 9, 1989, and applies to community water systems and those that serve the same 25 or more persons for at least 6 months. EPA requires industries to report spills of 1,000 pounds or more of trichloroethylene. It has been proposed that this level be reduced to 100 pounds.

Trichloroethylene levels in the workplace are regulated by the Occupational Safety and Health Administration (OSHA). The occupational exposure limit for an 8-hour workday, 40-hour workweek, is an average concentration of 100 ppm in air. The 15- minute average exposure in air that should not be exceeded at any time during a workday is 300 ppm. The OSHA standards are based on preventing central nervous system effects after trichloroethylene exposure.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological profile for trichloroethylene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

If you have questions or concerns, please contact your community or state health or environmental quality department or:

For more information, contact:
Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-62
Atlanta, GA 30333
Phone: 1-800-CDC-INFO · 888-232-6348 (TTY)
Fax: 1-770-488-4178
Email: cdcinfo@cdc.gov

ATSDR can also tell you the location of occupational and environmental health clinics. These clinics specialize in recognizing, evaluating, and treating illnesses resulting from exposure to hazardous substances.

Information line and technical assistance:
Phone: 888-422-8737
FAX: (770)-488-4178

To order toxicological profiles, contact:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Phone: 800-553-6847 or 703-605-6000

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